

Tom's Creek Wastewater System

Summary of Design Flows

and

Pipe Sizing

September 23, 2003

Tom's Creek Wastewater System

- Design Background

- 1975 Design

- 1997 Request Proposal to Finalize Design

- 1998 Preliminary Engineering Report

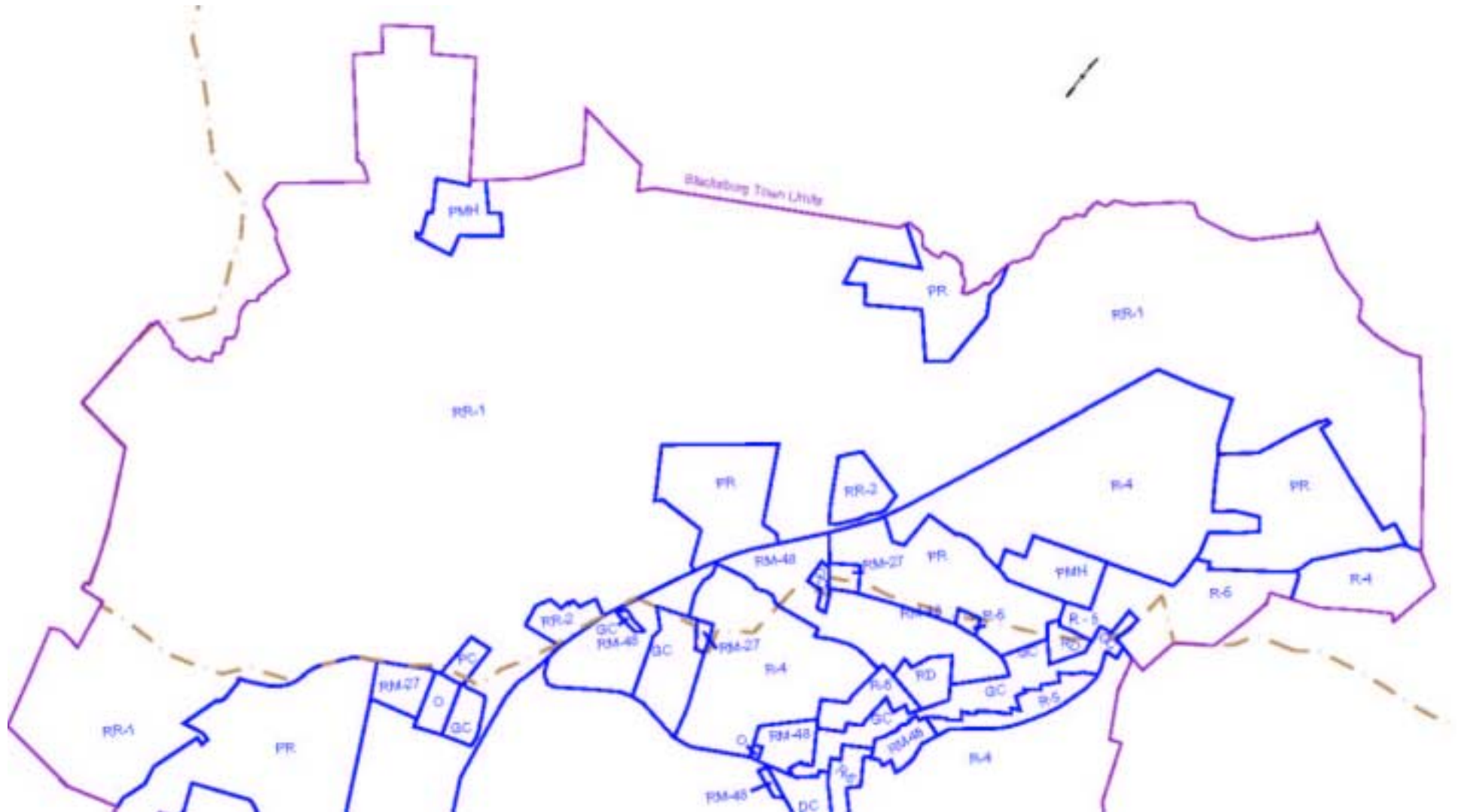
- Changed Conditions

- Current VDH Standards/Regs

- Current Environmental Issues/Regs

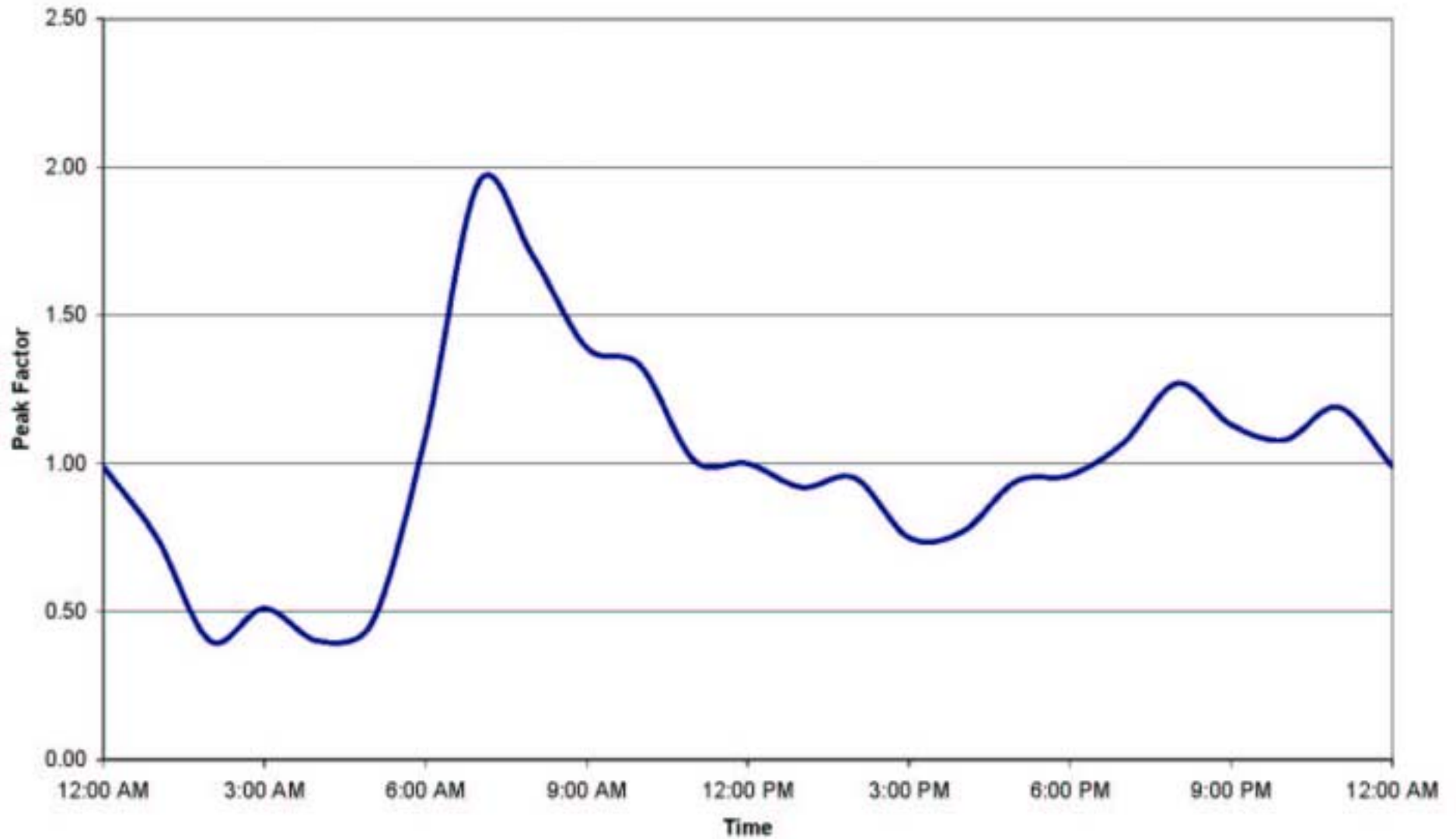
- Review/Verify Projected Flows

Tom's Creek Wastewater System



Tom's Creek Wastewater System

Tom's Creek Interceptor
Domestic Flow Diurnal



Tom's Creek Wastewater System

Summary of Design Basis

Tom's Creek Sewer Improvements

Projected Flows (Using Hydraulic Modelling)

From 1997 Study by Stafford Consultants, Inc.: (Direct Inputs to Model)

Shenandoah I Pump Station	1,183,250 gpd
Shenandoah II Pump Station	342,500 gpd
Givens Lane Pump Station	127,500 gpd

Approx. 200 Acres in County (upstream of Interceptor) (Direct Input to Model)	648,000 gpd
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Remainder of Basin within Town Based on Zoning

3938 Acres of	RR-1	Zoning @	320 gpd/acre
51 Acres of	RR-2	Zoning @	320 gpd/acre
367 Acres of	R-4	Zoning @	320 gpd/acre
48 Acres of	R-5	Zoning @	413 gpd/acre
4 Acres of	RM-27	Zoning @	954 gpd/acre
60 Acres of	RM-48	Zoning @	978 gpd/acre
356 Acres of	PR	Zoning @	394 gpd/acre
38 Acres of	PMH	Zoning @	743 gpd/acre
5 Acres of	GC	Zoning @	470 gpd/acre
9 Acres of	PC	Zoning @	671 gpd/acre

Peaks based on Town Sewer Study Diurnal

350 gpd per acre allowance for I&I

Total Peak Flow at Pump Station based on Model Results = 6,546,240 gpd or 4546 gpm

Tom's Creek Wastewater System

Summary of Flows to Tom's Creek Pump Station

						Existing Design		% of Flow	
						Peak Flow (gpd)	Peak Flow (gpm)		
Method 1									
From 1997 Study by Stafford Consultants, Inc.:									
Shenandoah I Pump Station						1,183,250	822	16.2%	
Shenandoah II Pump Station						342,500	238	4.7%	
Givens Lane Pump Station						127,500	89	1.7%	
Approx. 200 Acres in County (upstream of Interceptor)						648,000	450	8.9%	
Remainder of Basin within Town Based on Zoning									
3938 Acres of	RR-1	Zoning @	320 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	3,898,620	2707	53.3%	
51 Acres of	RR-2	Zoning @	320 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	50,490	35	0.7%	
367 Acres of	R-4	Zoning @	320 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	363,330	252	5.0%	
48 Acres of	R-5	Zoning @	413 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	56,448	39	0.8%	
4 Acres of	RM-27	Zoning @	954 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	9,032	6	0.1%	
60 Acres of	RM-48	Zoning @	978 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	138,360	96	1.9%	
356 Acres of	PR	Zoning @	394 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	405,128	281	5.5%	
38 Acres of	PMH	Zoning @	743 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	69,768	48	1.0%	
5 Acres of	GC	Zoning @	470 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	6,450	4	0.1%	
9 Acres of	PC	Zoning @	671 gpd/acre X	2.0 peak factor plus	350 gpd/acre I&I =	15,228	11	0.2%	
4876 Acres									
Totals						7,314,104	5079	100.0%	
Method 2 (Hydraulic Model)									
Actual Modelled Flows (Based on Diurnal and accounting for attenuation in lines)						6,546,240	4546		

Tom's Creek Wastewater System

Summary of Flows to Tom's Creek Pump Station

Method 3 (Standard VDH Approach)

From 1997 Study by Stafford Consultants, Inc.:

Shenandoah I Pump Station

Shenandoah II Pump Station

Givens Lane Pump Station

Approx. 200 Acres in County (upstream of Interceptor)

Remainder of Basin within Town Based on Zoning

3938 Acres of	RR-1	Zoning	400 gpd/acre X	2.5 peak factor
51 Acres of	RR-2	Zoning	700 gpd/acre X	2.5 peak factor
367 Acres of	R-4	Zoning	1200 gpd/acre X	2.5 peak factor
48 Acres of	R-5	Zoning	1600 gpd/acre X	2.5 peak factor
4 Acres of	RM-27	Zoning	2700 gpd/acre X	2.5 peak factor
60 Acres of	RM-48	Zoning	4800 gpd/acre X	2.5 peak factor
356 Acres of	PR	Zoning	800 gpd/acre X	2.5 peak factor
38 Acres of	PMH	Zoning	1200 gpd/acre X	2.5 peak factor
5 Acres of	GC	Zoning	470 gpd/acre X	2.5 peak factor
9 Acres of	PC	Zoning	671 gpd/acre X	2.5 peak factor

4876 Acres

Totals

Peak Flow (gpd)	Peak Flow (gpm)	
1,183,250	822	12.8%
342,500	238	3.7%
127,500	89	1.4%
648,000	450	7.0%
3,938,000	2735	42.7%
89,250	62	1.0%
1,101,000	765	11.9%
192,000	133	2.1%
27,000	19	0.3%
720,000	500	7.8%
712,000	494	7.7%
114,000	79	1.2%
5,875	4	0.1%
15,098	10	0.2%
9,215,473	6400	100.0%

Tom's Creek Wastewater System

Summary of Flows to Tom's Creek Connector

	<u>Existing Design</u>
Peak Flow to Pump Station (gpm)	4,546
Maximum Pump Rate (gpm)	6,000
Drainage Area	
680 Acres at 320 gpd/acre	468
Plus Peaking Factor of 2	
Plus 350 gpd/acre I&I)	
(673,200 gpd)	
Total	6,468

Tom's Creek Wastewater System

Potential Design Changes

Tom's Creek Sewer Improvements

Potential Change	Estimated Change in Peak Design Flows (of Interceptor Only)	
	gpd	gpm
Heritage Park (170 acres) originally based on RR-1 Zoning	-168,300	-117
Gateway Park (20 acres) originally based on RR-1 Zoning	-19,800	-14
Remove 200 Acres in County from Contributing Flows (based on proposed Comp Plan wording)	-648,000	-450
Portion of Basin (Phase 3 east of bypass) diverted to Crickets Court Trunk (Effects Sizing of Cricket's Court Only)	n/a	n/a
Westover Pumped into Karr Heights (Effects Sizing of Karr Heights Only)	n/a	n/a
Maple Ridge - 48 acres in Town formerly R-5, approved for 165 units.	75,552	52
Total Estimated Potential Change in Peak Design Flows	-760,548	-528
-10.4% of Existing Design (Based on Method1)		

Tom's Creek Wastewater System

Summary of Flows to Tom's Creek Pump Station

Method 1	Existing Design			Potential Changes		
	Peak Flow (gpd)	Peak Flow (gpm)	% of Flow	Change In Acreage	Peak Flow (gpd)	Peak Flow (gpm)
From 1997 Study by Stafford Consultants, Inc.:						
Shenandoah I Pump Station	1,183,250	822	16.2%		1,183,250	822
Shenandoah II Pump Station	342,500	238	4.7%		342,500	238
Glvens Lane Pump Station	127,500	89	1.7%		127,500	89
Approx. 200 Acres in County (upstre	648,000	450	8.9%	-200		County
Remainder of Basin within Town Based on Zoning						
3938 Acres of RR-1 Zoning =	3,898,620	2707	53.3%	-190	3,710,520	2577
51 Acres of RR-2 Zoning =	50,490	35	0.7%		50,490	35
367 Acres of R-4 Zoning =	363,330	252	5.0%		363,330	252
48 Acres of R-5 Zoning =	56,448	39	0.8%		56,448	39
4 Acres of RM-27 Zoning =	9,032	6	0.1%		9,032	6
60 Acres of RM-48 Zoning =	138,360	96	1.9%		138,360	96
356 Acres of PR Zoning =	405,128	281	5.5%		405,128	281
38 Acres of PMH Zoning =	69,768	48	1.0%		69,768	48
5 Acres of GC Zoning =	6,450	4	0.1%		6,450	4
9 Acres of PC Zoning =	15,228	11	0.2%		15,228	11
					75,552	Maple Ridge
4876 Acres						
Totals	7,314,104	5079	100.0%		6,553,556	4499 = 90% of Existing Design
Method 2 (Hydraulic Model)						
Actual Modelled Flows (Based on Diurnal and model)	6,546,240	4546			5,865,537	4,073
					(Estimated Modelled Flows based on 90% of Existing Design)	

Tom's Creek Wastewater System

Summary of Flows to Tom's Creek Connector

	<u>Existing Design</u>	<u>Potential Changes</u>	
Peak Flow to Pump Station (gpm)	4,546	4,073	
Maximun Pump Rate (gpm)	6,000	5,000	(Estimated)
Drainage Area			
680 Acres at 320 gpd/acre Plus Peaking Factor of 2 Plus 350 gpd/acre I&I (673,200 gpd)	468	468	
Total	6,468	5,468	(gpm)

Tom's Creek Wastewater System

SANITARY SEWER COMPUTATIONS

	Reference Descriptors From Point To Point		Total Accumulated Flow from PER (gpm) (gpd)		Diameter of Pipe (inches)	Slope (ft/ft)	Manning's Pipe Capacity (gpm)	Percent Capacity	Comments	
1a	W-8	W-7	6,468.00	9,313,920	30	0.0050	13,063.6	50%	Wall's Branch Critical Section	Existing Design
1b	W-8	W-7	6,468.00	9,313,920	24	0.0050	7,205.0	90%	Wall's Branch Critical Section	Dowsized
1c	W-8	W-7	5,468.00	7,873,920	24	0.0050	7,205.0	76%	Wall's Branch Critical Section	Potential Based on Recent Events
2a	T-2	T-1	4,546.00	6,546,240	30	0.0026	9,418.6	48%	Interceptor/Pump Station	Existing Design
2b	T-2	T-1	4,546.00	6,546,240	24	0.0026	5,194.7	88%	Interceptor/Pump Station	Dowsized
2c	T-2	T-1	4,073.29	5,865,537	24	0.0026	5,194.7	78%	Interceptor/Pump Station	Potential Based on Recent Events (89% Flow
3a	T-10	T-9	4,271.00	6,150,240	30	0.0026	9,420.2	45%	Interceptor/Karr Heights	Existing Design
3b	T-10	T-9	4,271.00	6,150,240	24	0.0026	5,195.6	82%	Interceptor/Karr Heights	Dowsized
3c	T-10	T-9	3,826.89	5,510,715	24	0.0026	5,195.6	74%	Interceptor/Karr Heights	Potential Based on Recent Events (89% Flow
4a	T-30	T-29	3,580.00	5,155,200	27	0.0027	7,233.1	49%	Interceptor/Brown Westover	Existing Design
4b	T-30	T-29	3,580.00	5,155,200	24	0.0027	5,283.4	68%	Interceptor/Brown Westover	Dowsized
4c	T-30	T-29	3,207.74	4,619,143	24	0.0027	5,283.4	61%	Interceptor/Brown Westover	Potential Based on Recent Events (89% Flow
5a	T-33	T-32	3,468.00	4,993,920	24	0.0046	6,900.2	50%	Interceptor/Shawnee	Existing Design
5b	T-33	T-32	3,468.00	4,993,920	18	0.0046	3,204.0	108%	Interceptor/Shawnee	Dowsized
5c	T-33	T-32	3,160.75	4,551,479	18	0.0046	3,204.0	99%	Interceptor/Shawnee	Potential Based on Recent Events (91% Flow
6a	TC-17	TC-16.2	2,828.00	4,072,320	24	0.0030	5,576.3	51%	Interceptor/Cricket's Court	Existing Design
6b	TC-17	TC-16.2	2,828.00	4,072,320	18	0.0030	2,589.3	109%	Interceptor/Cricket's Court	Dowsized
6c	TC-17	TC-16.2	2,577.45	3,711,529	18	0.0030	2,589.3	100%	Interceptor/Cricket's Court	Potential Based on Recent Events (91% Flow
7a	K-18	K-17	460.00	662,400	8	0.0087	506.5	91%	Karr Heights Critical Section	Existing Design
7b	K-18	K-17	555.00	799,200	8	0.0087	506.5	110%	Karr Heights Critical Section	Include Flow From Westover
7c	K-18	K-17	555.00	799,200	10	0.0087	918.3	60%	Karr Heights Critical Section	Include Flow From Westover

Tom's Creek Wastewater System

SANITARY SEWER COMPUTATIONS

	Reference Descriptors		Total Accumulated Flow from PER		Diameter of Pipe (inches)	Slope (ft/ft)	Manning's Pipe Capacity (gpm)	Percent Capacity	Comments	
	From Point	To Point	(gpm)	(gpd)						
1a	W-8	W-7	6,468.00	9,313,920	30	0.0050	13,063.6	50%	Wall's Branch Critical Section	Existing Design
1b	W-8	W-7	6,468.00	9,313,920	24	0.0050	7,205.0	90%	Wall's Branch Critical Section	Dowsized
1c	W-8	W-7	5,468.00	7,873,920	24	0.0050	7,205.0	76%	Wall's Branch Critical Section	Potential Changes
2a	T-2	T-1	4,546.00	6,546,240	30	0.0026	9,418.6	48%	Interceptor/Pump Station	Existing Design
2b	T-2	T-1	4,546.00	6,546,240	24	0.0026	5,194.7	88%	Interceptor/Pump Station	Dowsized
2c	T-2	T-1	4,073.29	5,865,537	24	0.0026	5,194.7	78%	Interceptor/Pump Station	Potential Changes
3a	T-10	T-9	4,271.00	6,150,240	30	0.0026	9,420.2	45%	Interceptor/Karr Heights	Existing Design
3b	T-10	T-9	4,271.00	6,150,240	24	0.0026	5,195.6	82%	Interceptor/Karr Heights	Dowsized
3c	T-10	T-9	3,826.89	5,510,715	24	0.0026	5,195.6	74%	Interceptor/Karr Heights	Potential Changes
4a	T-30	T-29	3,580.00	5,155,200	27	0.0027	7,233.1	49%	Interceptor/Brown Westover	Existing Design
4b	T-30	T-29	3,580.00	5,155,200	24	0.0027	5,283.4	68%	Interceptor/Brown Westover	Dowsized
4c	T-30	T-29	3,207.74	4,619,143	24	0.0027	5,283.4	61%	Interceptor/Brown Westover	Potential Changes
5a	T-33	T-32	3,468.00	4,993,920	24	0.0046	6,900.2	50%	Interceptor/Shawnee	Existing Design
5b	T-33	T-32	3,468.00	4,993,920	18	0.0046	3,204.0	108%	Interceptor/Shawnee	Dowsized
5c	T-33	T-32	3,160.75	4,551,479	18	0.0046	3,204.0	99%	Interceptor/Shawnee	Potential Changes
6a	C-1	C-16	2,828.00	4,072,320	24	0.0030	5,576.3	51%	Interceptor/Cricket's Court	Existing Design
6b	C-1	C-16	2,828.00	4,072,320	18	0.0030	2,589.3	109%	Interceptor/Cricket's Court	Dowsized
6c	C-1	C-16	2,577.45	3,711,529	18	0.0030	2,589.3	100%	Interceptor/Cricket's Court	Potential Changes
7a	K-18	K-17	460.00	662,400	8	0.0087	506.5	91%	Karr Heights Critical Section	Existing Design
7b	K-18	K-17	555.00	799,200	8	0.0087	506.5	110%	Karr Heights Critical Section	Flow From Westove
7c	K-18	K-17	555.00	799,200	10	0.0087	918.3	60%	Karr Heights Critical Section	Flow From Westove